TrenchMOS™ transistor Logic level FET

PHT6N06LT

GENERAL DESCRIPTION

N-channel enhancement mode logic level field-effect power transistor in a plastic envelope suitable for surface mounting. The device features very low on-state resistance and has integral zener diodes giving ESD protection. It is intended for use in DC-DC converters and general purpose switching applications.

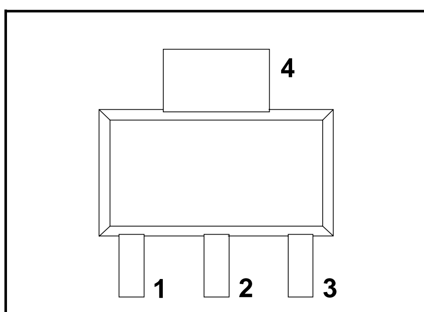
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
V_{DS}	Drain-source voltage	55	V
I_D	Drain current (DC) T_{sp} = 25 ˚C	5.5	A
	Drain current (DC) T_{amb} = 25 ˚C	2.5	A
P_{tot}	Total power dissipation	8.3	W
T_j	Junction temperature	150	˚C
$R_{DS(ON)}$	Drain-source on-state resistance V_{GS} = 5 V	150	mΩ

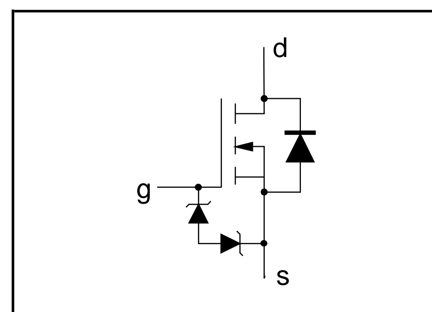
PINNING - SOT223

PIN	DESCRIPTION
1	gate
2	drain
3	source
4	drain (tab)

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	Drain-source voltage	-	-	55	V
V_{DGR}	Drain-gate voltage	R_{GS} = 20 kΩ	-	55	V
V_{GS}	Gate-source voltage	-	-	±13	V
I_D	Drain current (DC)	T_{sp} = 25 ˚C	-	5.5	A
		T_{amb} = 25 ˚C	-	2.5	A
I_D	Drain current (DC)	T_{sp} = 100 ˚C	-	3.8	A
		T_{amb} = 100 ˚C	-	1.75	A
I_{DM}	Drain current (pulse peak value)	T_{sp} = 25 ˚C	-	22	A
		T_{amb} = 25 ˚C	-	10	A
P_{tot}	Total power dissipation	T_{sp} = 25 ˚C	-	8.3	W
		T_{amb} = 25 ˚C	-	1.8	W
T_{stg}, T_j	Storage & operating temperature	-	- 55	150	˚C

ESD LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (100 pF, 1.5 kΩ)	-	2	kV

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}sp}$ $R_{th\ j\text{-}amb}$	From junction to solder point From junction to ambient	Mounted on any PCB Mounted on PCB of Fig.17	12 -	15 70	K/W K/W

STATIC CHARACTERISTICS

T_j= 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.25 mA	55	-	-	V
		T_j = -55˚C	50	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	V_{DS} = V_{GS}; I_D = 1 mA	1.0	1.5	2.0	V
		T_j = 150˚C	0.6	-	-	V
		T_j = -55˚C	-	-	2.3	V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 55 V; V_{GS} = 0 V;	-	0.05	10	µA
		T_j = 150˚C	-	-	100	µA
I_{GSS}	Gate source leakage current	V_{GS} = ±5 V	-	0.02	1	µA
		T_j = 150˚C	-	-	5	µA
$\pm V_{(BR)GSS}$	Gate source breakdown voltage	V_{GS} = ±1 mA	10	-	-	V
$R_{DS(ON)}$	Drain-source on-state resistance	V_{GS} = 5 V; I_D = 5 A	-	120	150	mΩ
		T_j = 150˚C	-	-	277	mΩ

DYNAMIC CHARACTERISTICS

T_{mb} = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	V_{DS} = 25 V; I_D = 5 A; T_j = 25˚C	3	5	-	S
$Q_{g(tot)}$ Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain (Miller) charge	I_D = 5 A; V_{DD} = 44 V; V_{GS} = 5 V	- - -	4.5 1 2.5	- - -	nC nC nC
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Feedback capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz	- - -	250 65 35	330 80 50	pF pF pF
$t_{d\ on}$ t_r $t_{d\ off}$ t_f	Turn-on delay time Turn-on rise time Turn-off delay time Turn-off fall time	V_{DD} = 30 V; I_D = 5 A; V_{GS} = 5 V; R_G = 10 Ω; T_j = 25˚C	- - - -	11 38 25 20	17 60 38 38	ns ns ns ns

REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

T_j = -55 to 175˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	T_{sp} = 25˚C	-	-	5.5	A
I_{DRM}	Pulsed reverse drain current	T_{sp} = 25˚C	-	-	30	A
V_{SD}	Diode forward voltage	I_F = 2 A; V_{GS} = 0 V	-	0.85	1.1	V
t_{rr} Q_{rr}	Reverse recovery time Reverse recovery charge	I_F = 2 A; -dI_F/dt = 100 A/µs; V_{GS} = -10 V; V_R = 30 V	- -	43 0.16	- -	ns µC

AVALANCHE LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
W_{DSS}	Drain-source non-repetitive unclamped inductive turn-off energy	I_D = 1.9 A; V_{DD} ≤ 25 V; V_{GS} = 5 V; R_{GS} = 50 Ω; T_{sp} = 25 ˚C	-	-	15	mJ

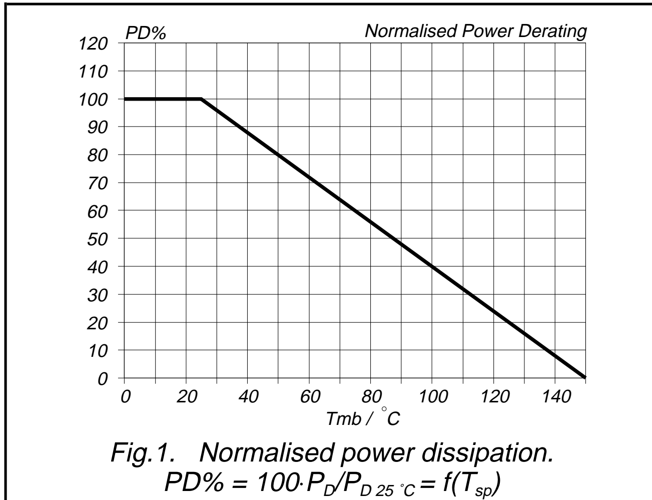


Fig.1. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25\,^\circ C} = f(T_{sp})$

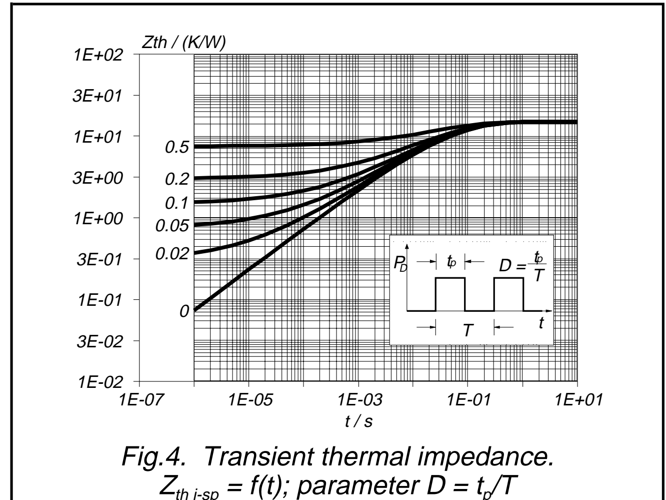


Fig.4. Transient thermal impedance.
$Z_{th\,j\text{-}sp} = f(t)$; parameter $D = t_p/T$

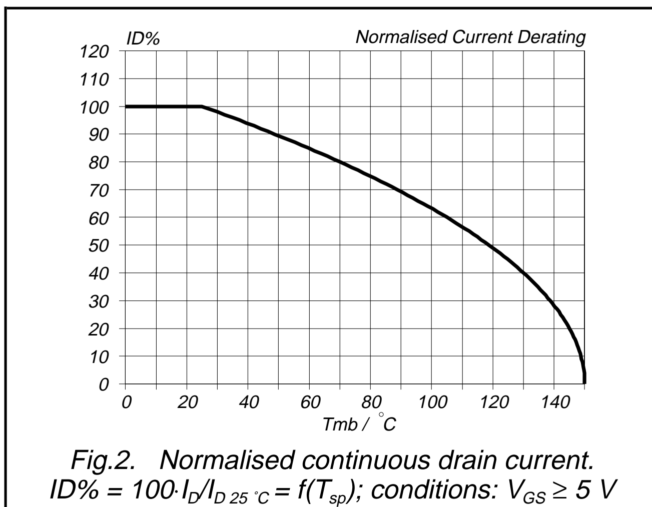


Fig.2. Normalised continuous drain current.
$ID\% = 100 \cdot I_D/I_{D\,25\,^\circ C} = f(T_{sp})$; conditions: $V_{GS} \geq 5$ V

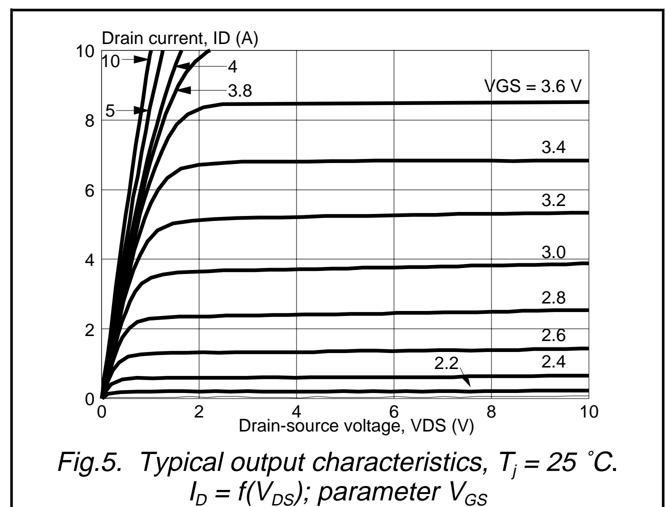


Fig.5. Typical output characteristics, $T_j = 25\ ^\circ C$.
$I_D = f(V_{DS})$; parameter V_{GS}

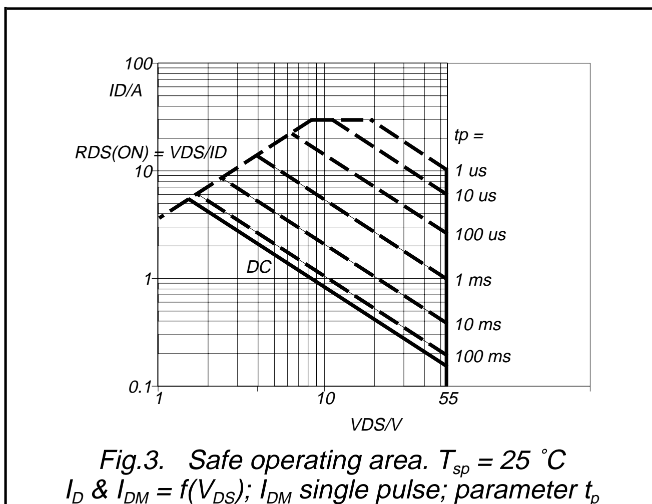


Fig.3. Safe operating area. $T_{sp} = 25\ ^\circ C$
I_D & $I_{DM} = f(V_{DS})$; I_{DM} single pulse; parameter t_p

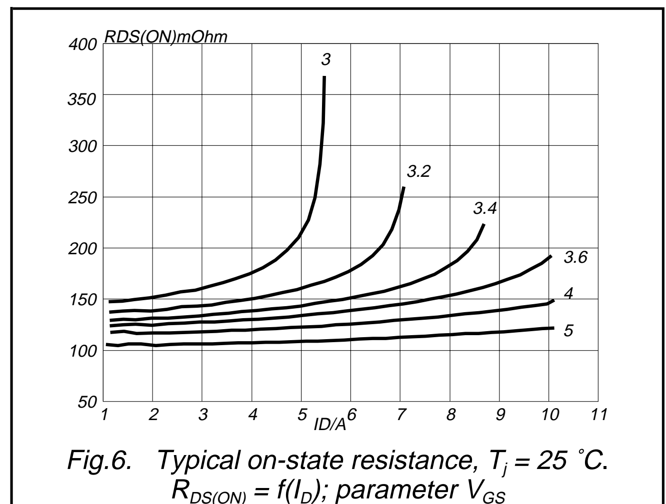


Fig.6. Typical on-state resistance, $T_j = 25\ ^\circ C$.
$R_{DS(ON)} = f(I_D)$; parameter V_{GS}

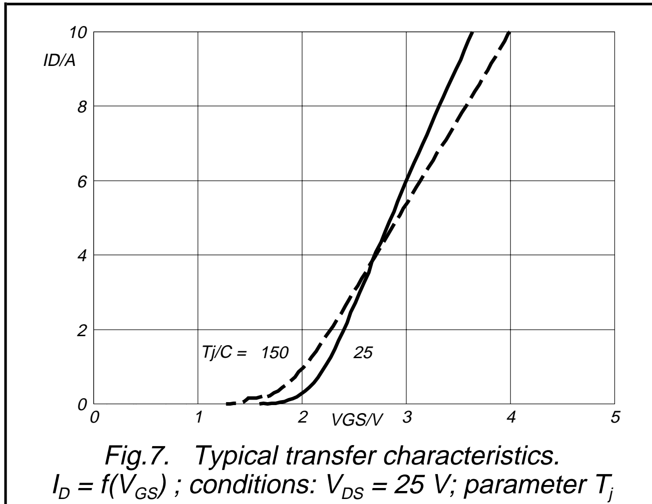


Fig.7. Typical transfer characteristics.
$I_D = f(V_{GS})$; conditions: $V_{DS} = 25$ V; parameter T_j

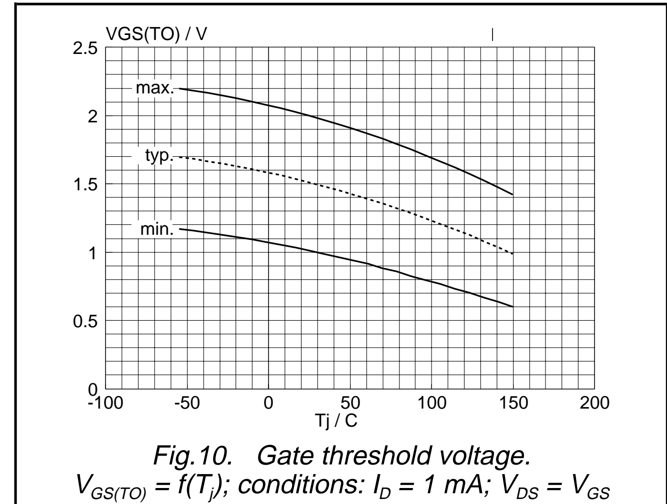


Fig.10. Gate threshold voltage.
$V_{GS(TO)} = f(T_j)$; conditions: $I_D = 1$ mA; $V_{DS} = V_{GS}$

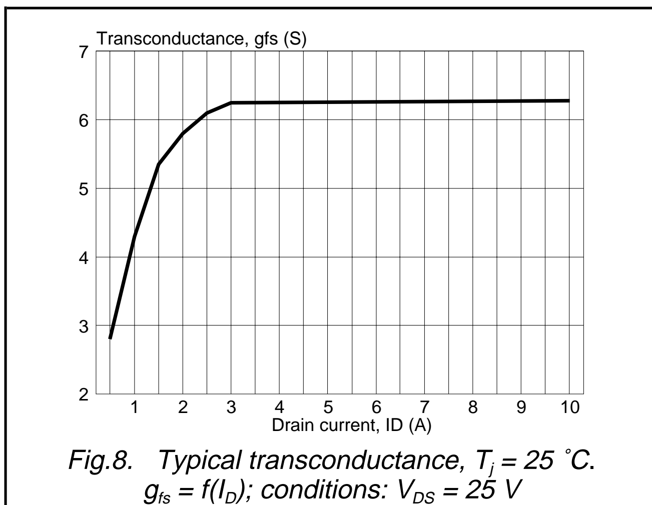


Fig.8. Typical transconductance, $T_j = 25$ ˚C.
$g_{fs} = f(I_D)$; conditions: $V_{DS} = 25$ V

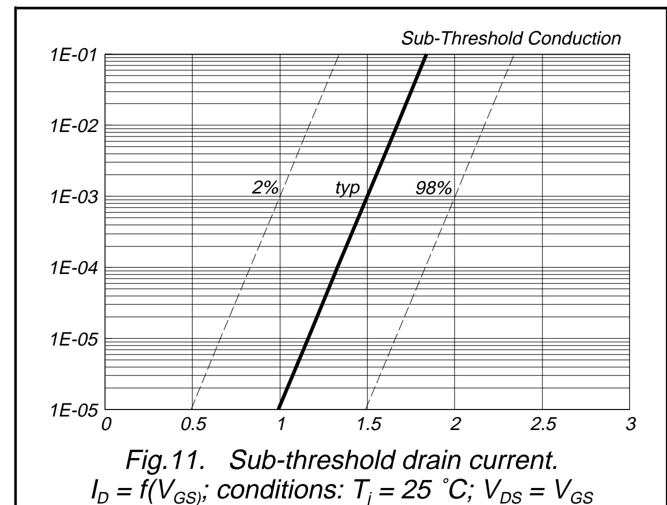


Fig.11. Sub-threshold drain current.
$I_D = f(V_{GS})$; conditions: $T_j = 25$ ˚C; $V_{DS} = V_{GS}$

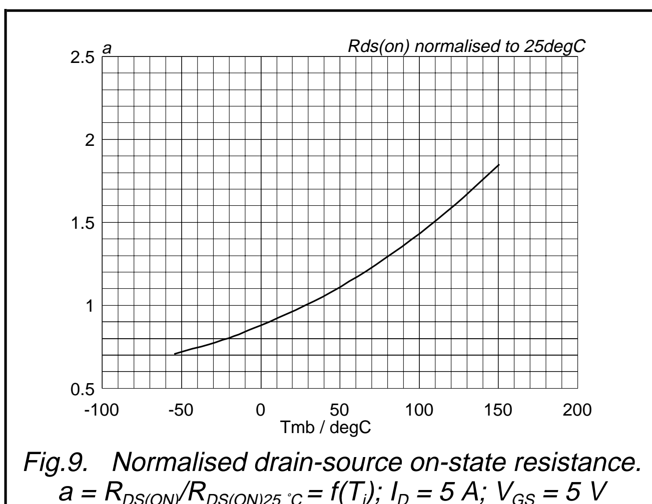


Fig.9. Normalised drain-source on-state resistance.
$a = R_{DS(ON)}/R_{DS(ON)25\ ˚C} = f(T_j)$; $I_D = 5$ A; $V_{GS} = 5$ V

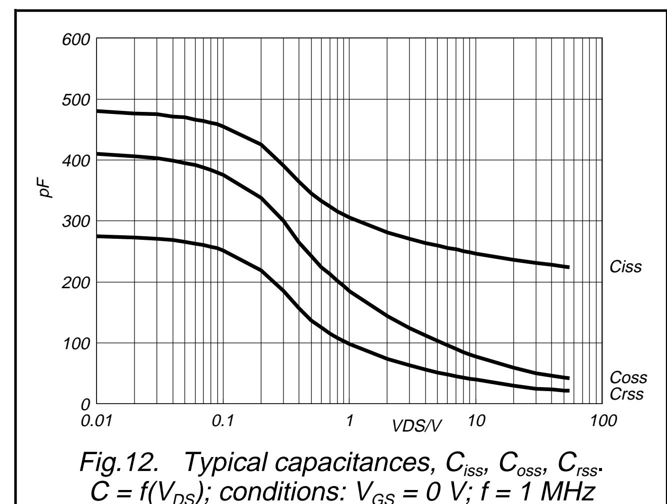


Fig.12. Typical capacitances, C_{iss}, C_{oss}, C_{rss}.
$C = f(V_{DS})$; conditions: $V_{GS} = 0$ V; f = 1 MHz

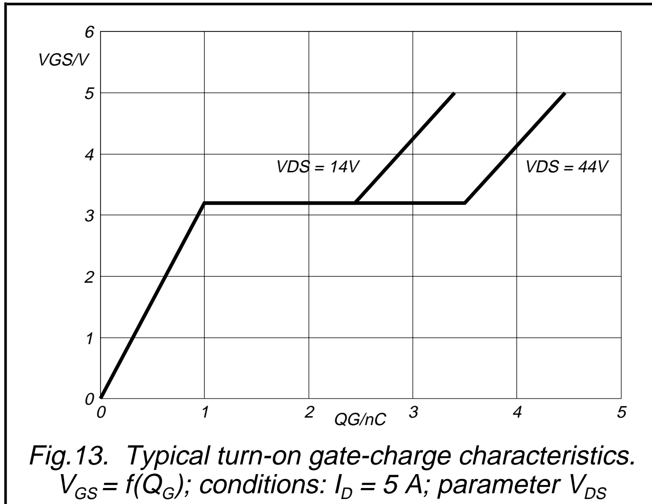


Fig.13. Typical turn-on gate-charge characteristics.
$V_{GS} = f(Q_G)$; conditions: $I_D = 5$ A; parameter V_{DS}

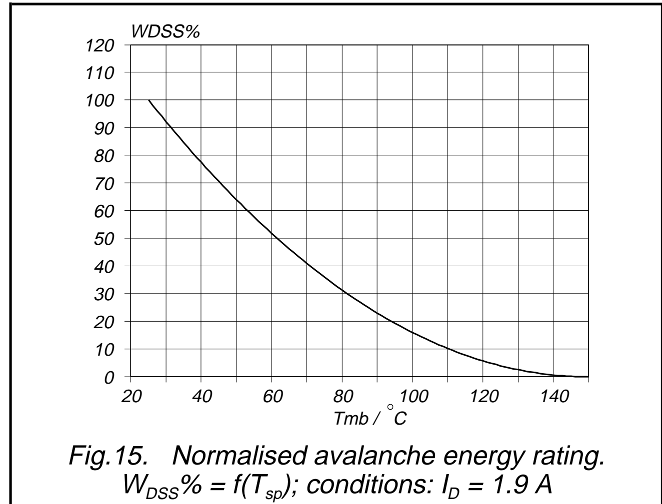


Fig.15. Normalised avalanche energy rating.
$W_{DSS}\% = f(T_{sp})$; conditions: $I_D = 1.9$ A

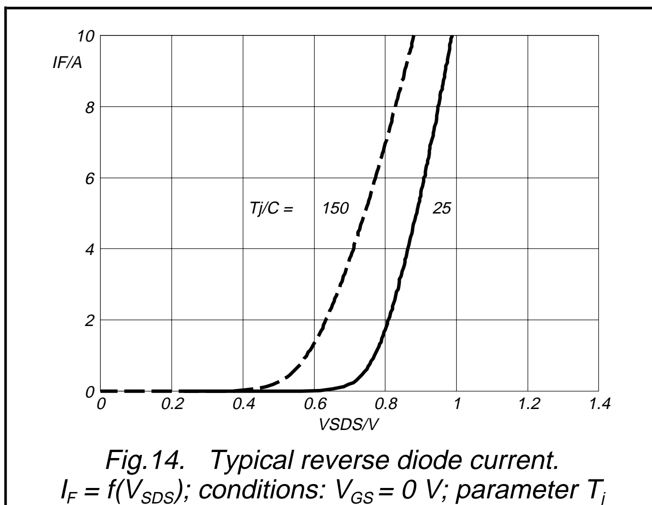


Fig.14. Typical reverse diode current.
$I_F = f(V_{SDS})$; conditions: $V_{GS} = 0$ V; parameter T_j

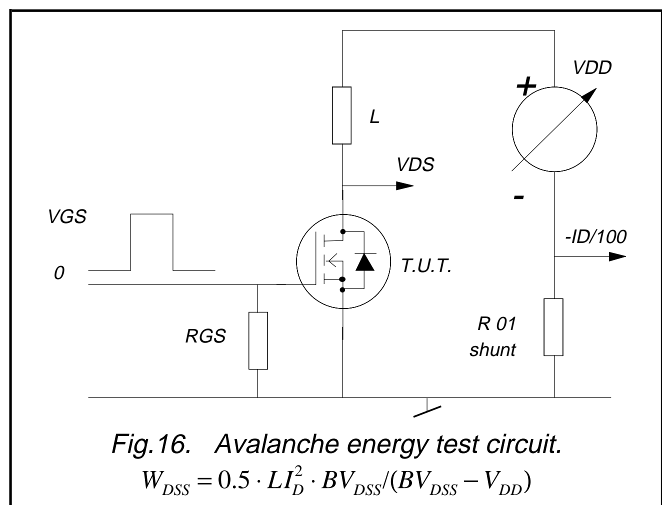


Fig.16. Avalanche energy test circuit.
$W_{DSS} = 0.5 \cdot LI_D^2 \cdot BV_{DSS}/(BV_{DSS} - V_{DD})$

PRINTED CIRCUIT BOARD

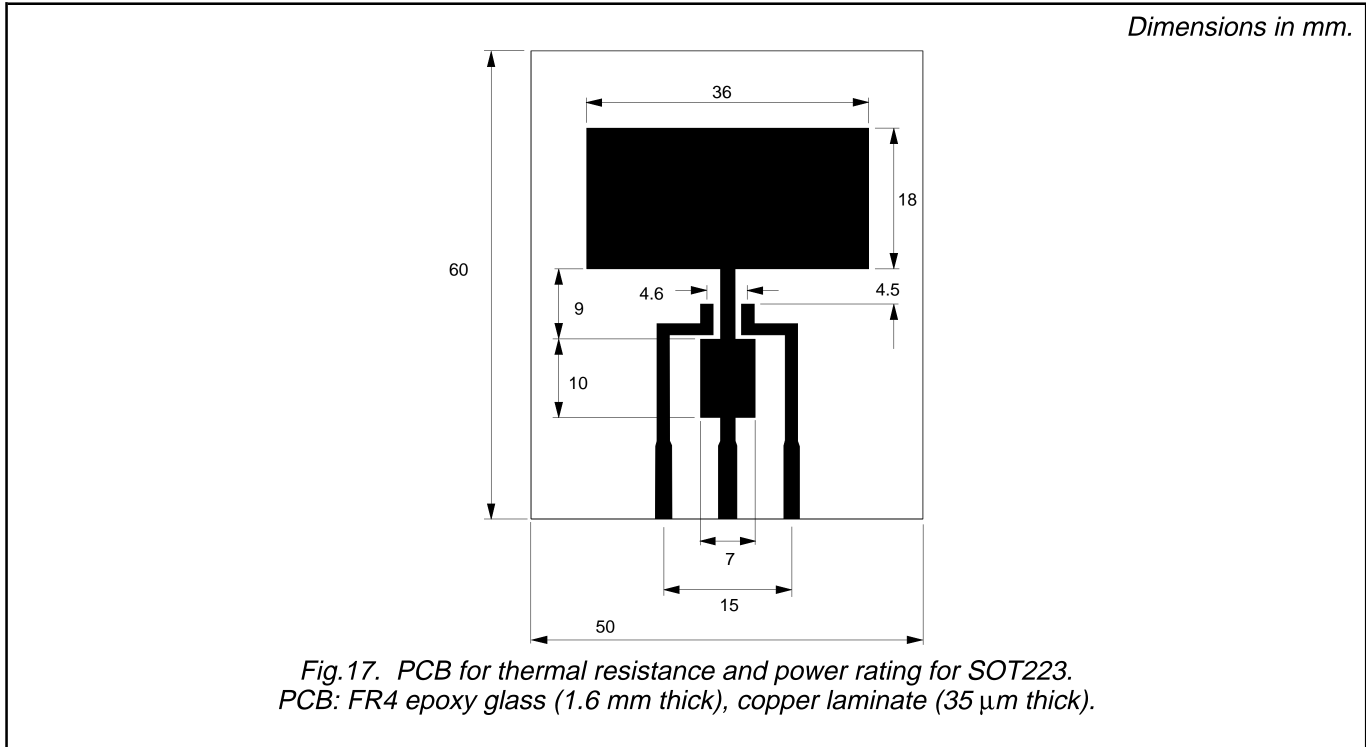


Fig.17. PCB for thermal resistance and power rating for SOT223.
PCB: FR4 epoxy glass (1.6 mm thick), copper laminate (35 µm thick).

MECHANICAL DATA

Dimensions in mm

Net Mass: 0.11 g

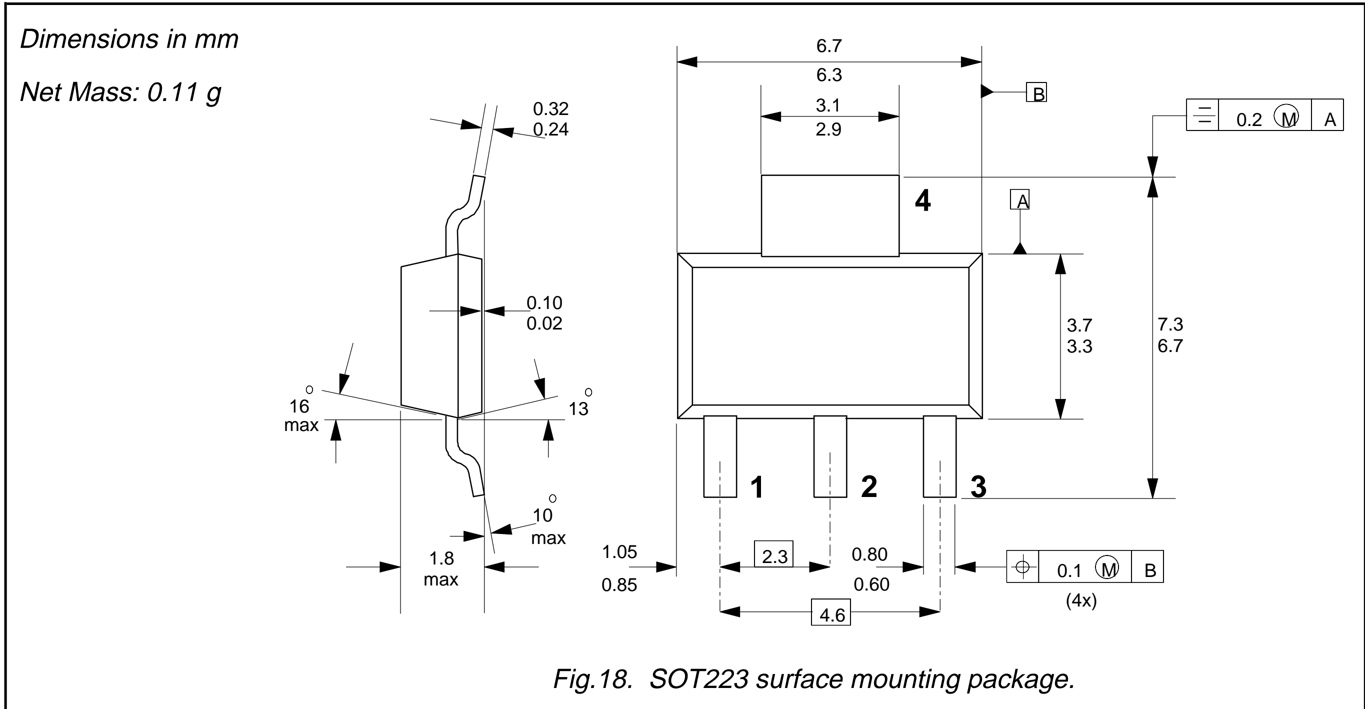


Fig.18. SOT223 surface mounting package.

Notes

1. Observe the general handling precautions for electrostatic-discharge sensitive devices (ESDs) to prevent damage to MOS gate oxide.
2. Refer to surface mounting instructions for SOT223 envelope.
3. Epoxy meets UL94 V0 at 1/8".

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	
© Philips Electronics N.V. 1998	
All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.	
The information presented in this document does not form part of any quotation or contract, it is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent or other industrial or intellectual property rights.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.